MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 1, 2016/2017

EBT 3026 – BIOMETRICS

(BE)

19 OCTOBER 2016
2.30 p.m – 4.30 p.m
(2 Hours)

INSTRUCTIONS TO STUDENT

1. This Question paper consists of 5 pages with 4 Questions only.
2. Answer **ALL** questions. All questions carry equal marks and the distribution of the marks for each question is given.
3. Please write all your answers in the Answer Booklet provided.

Question 1

a) Explain two objectives of personal identification. [2 marks]

b) Highlight the advantages of personal identification using 'what you are' compared to the personal identification methods using 'what you have' and 'what you know'. [4 marks]

c) A unimodal 2-category multi-biometric system with a single input, and 3 matcher units is shown in Figure Q1. The database consists of two templates corresponding to user A and B. The matching score for an unknown subject's feature vector X is given by Table Q1. The feature extractor produces four feature values, each of which ranges from 0 to 20.

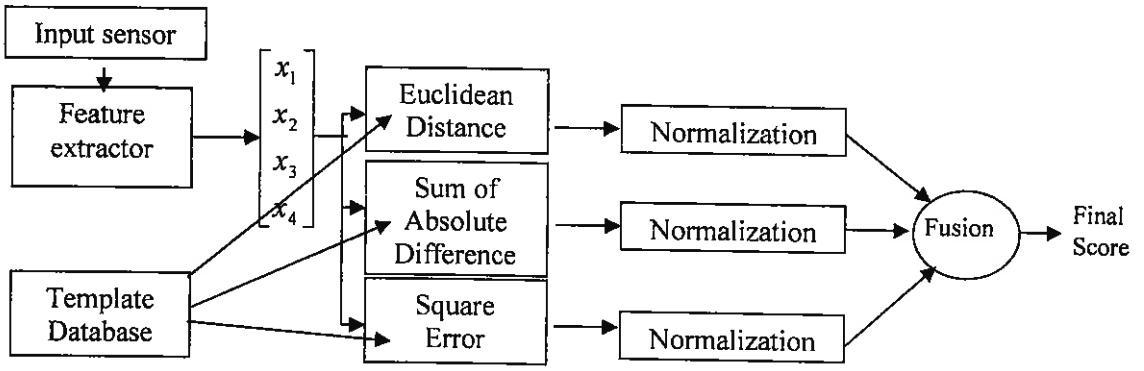

Figure Q1

Table Q1

Matcher	Matching Score	
	User A	User B
Euclidean Distance	23.64	22.49
Sum of Absolute Difference	37	32
Square Error	559	506

i. Find the minimum and maximum dissimilarity values for each matcher. [6 marks]

ii. Calculate the corresponding normalized dissimilarity scores using the min - max method of normalization. [6 marks]

iii. Calculate the final matching scores in terms of similarity measure using mean fusion rule. [6 marks]

iv. What is the final decision of the system? [1 mark]

Continued...

Question 2

a) Image segmentation is a process of partitioning a digital image into multiple segments. One way to do image segmentation is by using K-means clustering. Describe the K-means clustering algorithm. [4 marks]

b) Consider a dataset consisting of the scores of two variables (x, y) for seven individuals is given in Table Q2. This dataset is going to be grouped into 2 clusters.

Table Q2

Subject	x	y
1	1.0	1.0
2	1.5	2.0
3	3.0	4.0
4	5.0	7.0
5	3.5	5.0
6	4.5	5.0
7	3.5	4.5

i. Let the x and y values of the two individuals furthest apart (using Euclidean distance measure) be the first step finding the initial partition. Define the initial cluster means. [4 marks]

ii. Examine the remaining individuals in sequence and allocate them to the correct cluster based on their Euclidean distance measure. [10 marks]

iii. Determine if each individual has been assigned to the right cluster. [7 marks]

Continued...

Question 3

a) Briefly explains the term non-invasive biometrics in personal identification. [4 marks]

b) Discuss the pros and cons of having a non-invasive iris recognition system in terms of its performance, acceptability and circumvention. [9 marks]

c) Figure Q3 shows the pixel intensity values in a 4 by 4 block taken from a retina image.

174	231	232	233
139	202	228	235
100	134	171	202
95	92	97	123

Figure Q3

i. Write the Sobel operator for approximating horizontal and vertical derivatives. [2 marks]

ii. Derive the gradient image for the central 2 by 2 image sub-block depicted by the shaded region using the Sobel operator. [4 marks]

iii. Give the gradient values in the root mean square sense. [6 marks]

Continued...

Question 4

a) Illustrate the fingerprint verification system using a block diagram. [7 marks]

b) Figure Q4a shows the 5 by 5 pixel intensities of an extracted region from a fingerprint image. After a 2-step skeletonization using the 8-neighbourhood based technique on the 3x3 region, the image is thinned into Figure Q4b.

0	0	0	0	1
0	0	0	1	1
0	0	1	1	1
1	1	1	1	1
1	1	1	0	0

Figure Q4a

0	0	0	0	1
0	0	0	0	1
0	0	0	1	1
1	0	1	0	1
1	1	1	0	0

Figure Q4b

i. Show the output after the first step of the skeletonization of Figure Q4a. [6 marks]

ii. Skeletonization is part of prepossessing steps in minutiae extraction. Explain the overall preprocessing steps involved in minutiae extraction and why we need each of them. [12 marks]

End of Paper